471, 2006; M. D. Costa et al., "Dynamical glucometry: use of multiscale entropy analysis in diabetes," Chaos, 24(3): 033139, 2014; [28]) that can report, in real-time, on salient aspects of integrative, multiscale, regulatory systems and of their breakdown with aging and disease. The use of these probes may enhance the clinical utility of traditional risk assessment tools (FIG. **19** and FIG. **20**) and of other emerging technologies, such as genomic profiling. In furtherance of the goals of precision medicine, the dynamical property of HRF may also constitute a novel target for therapeutic interventions.

CONCLUSION

[0265] Analysis of short-term HRV is enhanced by a set of computational tools that quantify the fragmentation of heartbeat variability, defined by abrupt changes in the sign of HR acceleration. For example, heart rate fragmentation (HRF) is a manifestation of anomalous short-term sino-atrial variability. In a Holter monitor database from healthy subjects, the degree of fragmentation increased with the participants' age. In particular, HRF was associated with increased risk of cardiac adverse events and cardiac mortality in MESA. Furthermore, fragmentation measures outperformed traditional short-term measures of HRV in discriminating a group of patients with CAD and from the healthy subjects. Fragmentation of sinus rhythm cadence may support a new class of dynamical biomarkers that probe the integrity of the regulatory network comprising neuroautonomic, sinus node and atrial components.

[0266] FIGS. **1-24** as described herein are illustrative examples allowing an explanation of the present invention. It should be understood that embodiments of the present invention could be implemented in hardware, firmware, software, or a combination thereof. In such an embodiment, the various components and steps would be implemented in hardware, firmware, and/or software to perform the functions of the present invention. That is, the same piece of hardware, firmware, or module of software could perform one or more of the illustrated blocks (i.e., components or steps).

[0267] The present invention can be implemented in one or more computer systems capable of carrying out the functionality described herein. Referring to FIG. **25**, an example computer system **2500** useful in implementing the present invention is shown. Various embodiments of the invention are described in terms of this example computer system **2500**. After reading this description, it will become apparent to one skilled in the relevant art(s) how to implement the invention using other computer systems and/or computer architectures.

[0268] The computer system **2500** includes one or more processors, such as processor **2504**. The processor **2504** is connected to a communication infrastructure **2506** (e.g., a communications bus, crossover bar, or network).

[0269] Computer system **2500** can include a display interface **2502** that forwards graphics, text, and other data from the communication infrastructure **2506** (or from a frame buffer not shown) for display on the display unit **2530**.

[0270] Computer system **2500** also includes a main memory **2508**, preferably random access memory (RAM), and can also include a secondary memory **2510**. The secondary memory **2510** can include, for example, a hard disk drive **2512** and/or a removable storage drive **2514**, representing a floppy disk drive, a magnetic tape drive, an optical disk drive, etc. The removable storage drive **2514** reads from and/or writes to a removable storage unit **2518** in a well-known manner. Removable storage unit **2518**, represents a floppy disk, magnetic tape, optical disk, etc. which is read by and written to removable storage drive **2514**. As will be appreciated, the removable storage unit **2518** includes a computer usable storage medium having stored therein computer software (e.g., programs or other instructions) and/or data.

[0271] In alternative embodiments, secondary memory **2510** can include other similar means for allowing computer software and/or data to be loaded into computer system **2500**. Such means can include, for example, a removable storage unit **2522** and an interface **2520**. Examples of such can include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an EPROM, or PROM) and associated socket, and other removable storage units **2522** and interfaces **2520** which allow software and data to be transferred from the removable storage unit **2522** to computer system **2500**.

[0272] Computer system **2500** can also include a communications interface **2524**. Communications interface **2524** allows software and data to be transferred between computer system **2500** and external devices. Examples of communications interface **2524** can include a modem, a network interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, etc. Software and data transferred via communications interface **2524** are in the form of signals **2528** which can be electronic, electromagnetic, optical, or other signals capable of being received by communications interface **2524**. These signals **2528** are provided to communications interface **2524** via a communications path (i.e., channel) **2526**. Communications path **2526** carries signals **2528** and can be implemented using wire or cable, fiber optics, a phone line, a cellular phone link, an RF link, free-space optics, and/or other communications channels.

[0273] In this document, the terms "computer program medium" and "computer usable medium" are used to generally refer to media such as removable storage unit **2518**, removable storage unit **2522**, a hard disk installed in hard disk drive **2512**, and signals **2528**. These computer program products are means for providing software to computer system **2500**. The invention is directed to such computer program products.

[0274] Computer programs (also called computer control logic or computer readable program code) are stored in main memory **2508** and/or secondary memory **2510**. Computer programs can also be received via communications interface **2524**. Such computer programs, when executed, enable the computer system **2500** to implement the present invention as discussed herein. In particular, the computer programs, when executed, enable the processor **2504** to implement the processes of the present invention described above. Accordingly, such computer programs represent controllers of the computer system **2500**.

[0275] In an embodiment where the invention is implemented using software, the software can be stored in a computer program product and loaded into computer system **2500** using removable storage drive **2514**, hard disk drive **2512**, interface **2520**, or communications interface **2524**. The control logic (software), when executed by the processor **2504**, causes the processor **2504** to perform the functions of the invention as described herein.